Qualitatively and quantitatively describe the motion of charged particles in a dipole magnetic field.
Derive the fluid equations
Analyze the conditions for MHD equilibria
Describe MHD wave propagation in a magnetized plasma with particular emphasis given to momentum and energy transport by Alfven waves.
Analyze the jump conditions at MHD shocks and discontinuities.
Understand the origin of plasma waves from two fluid equations and the Vlasov equation.
Understand the origin of plasma instabilities.

Textbook: There is no textbook requirement for this course. But the following textbooks are highly recommended:

D. R. Nicholson, *Introduction to Plasma Theory*, John Wiley & Sons Inc (June 1, 1983), ISBN-10: 047109045X, ISBN-13: 978-0471090458 (Unfortunately this book is out of print but it is available in the GI-IARC Library).

George Parks, *Physics of Space Plasmas: An Introduction, Second Edition*, Westview Press (2003), ISBN-10: 0813341302.

D. A. Gurnett and A. Bhattacharjee, *Introduction to Plasma Physics*, Cambridge, 2005 (ISBN 0 521 36730 1 paperback).

Francis F Chen, *Introduction to Plasma Physics and Controlled Fusion, Volume 1: Plasma Physics*, Plenum Press, 2nd Edition, 1984.

Tom Cravens, *Physics of Solar System Plasmas*, Cambridge University Press, 1997.

Krall and Trivelpiece, *Principles of Plasma Physics*, San Francisco Press (1986).

Baumjohann and Treumann, *Basic Space Plasma Physics*, Imperial College Press (1997).

Fletcher, *Computational Techniques for Fluid Dynamics, I and II*, Springer (1988):

Potter, *Computational Physics*, John Wiley (1973)

Birdsall and Langdon, *Plasma Physics via Computer Simulation*, IOP (1995, based on 1985 original)

Stephan Jardin, *Computational Methods in Plasma Physics*, Chapman & Hall/CRC Computational Science Series:

Programming languages: Students are welcome to submit programming solutions in the language of their choice. Recommended languages for this course are Matlab, IDL, and Python.

Grading:

Homework	50%
Midterm Exam	20%
Final Exam	30%

Course Policies:

(a) Attendance and participation in class is expected of all students.
(b) Assignments are due at the beginning of class on the due date.
(c) Students are encouraged to work together on homework problems, but the final written solutions must be individual work.
(d) Students must acknowledge all sources of information { included fellow students { used in homework solutions and final projects. The UAF catalog states: \The university may initiate disciplinary action and impose disciplinary sanctions against any student or student organization found responsible for committing, attempting to commit or intentionally assisting in the commission of . . . cheating, plagiarism, or other forms of academic dishonesty. . . \
(e) All UA student academics and regulations are adhered to in this course. You may find these in the UAF catalog (section \Academics and Regulations").

COVID-19 statement:

UAF Department of Equity and Compliance
1692 Tok Lane, 3rd oor, Constitution Hall, Fairbanks, AK 99775
907-474-7300
uaf-deo@alaska.edu

Additional syllabi statement for courses including o -campus programs and research activities:
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We want you to know that:

- UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.
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- There are supportive measures available to individuals that may have experienced discrimination.
- University of Alaska's Board of Regents' Policy & University Regulations (UA BoR P&R) 01.02.020 Nondiscrimination and 01.04 Sex and Gender-Based Discrimination Under Title IX, go to: http://alaska.edu/bor/policy-regulations/.
- UA BoR P&R apply at all university owned or operated sites, university sanctioned events, clinical sites and during all academic or research related travel that are university sponsored.

For further information on your rights and resources go to https://www.alaska.edu/equity/title-ix/student-placement-guidelines/.

Schedule:

Topic	Week	Dates
Plasma Basics	1	Aug 28
Single Particle Motion	1	Aug 30 - Sept 1
Labor Day{no class	2	Sept 4
Kinetic Theory I: phase space and distribution functions	2	Sept 6-8
Derivation of the uid equations	3	Sept 11-15
Magnetohydrodynamic (MHD) equations	4	Sept 18-22
Properties of MHD (Frozen in condition, entropy)	5	Sept 25-29
MHD equilibria	6	Oct 2 - 6
MHD stability and waves	7	Oct 9 - 13
Midterm Exam	8	Oct 16
MHD shocks and discontinuities	8	Oct 18 - 20
Magnetic reconnection	9	Oct 23 - 27
Fluid instabilities	10	Oct 30 - Nov 3
Two- uid equation and waves	11	Nov 6 - 10
Kinetic theory II: Klimontovich Equation	12	Nov 13 - 17
Kinetic theory II: Liouville & Lenard-Balescu equations	13	Nov 20
Thanksgiving break{no class	13	Nov 22-24
Vlasov Equation and waves	14-15	Nov 27 - Dec 6
Review	15	Dec 8
Final exam	16	10:15{ 12:15, Friday, Dec 15